The Impact of Assistive Technology on Vocabulary Acquisition of a Middle School Student with Learning Disabilities and Limited English Proficiency

A Descriptive Case Study Analysis

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Abstract

Vocabulary acquisition traditionally has been a struggle for students with special learning needs. This study involved an eleven year old fifth grade student with learning disabilities in reading and writing and limited English proficiency. Assistive technology assistance was provided from the Franklin Language Master 6000b and Microsoft's Power Point 2003. Visual representation (e.g., student drawings) was also used to aid student connections to an individual vocabulary word in the context of the text read. Best practices pedagogy (i.e., trade book use, choice, discovery, interactive learning, reciprocal teaching, and repetition) were utilized and have been framed in a lesson structure entitled, Individualized Direct Vocabulary Discovery Method with Assistive Technological Scaffolding (IDVDMATS). This case study provides readers rich descriptions of the special vocabulary learning needs of one student following the IDVDMATS approach.

The Impact of Assistive Technology on Vocabulary Acquisition of a Middle School Student with Learning Disabilities and Limited English Proficiency

Reading, writing, spelling, and vocabulary building activities are the nature and emphasis of literacy instruction in American schools today and are troublesome activities for many students (Choate, 2000; Donaldson and Nash, 2005; Gentry, 1995; Hardman, Drew, and Egan, 2005). Students with learning challenges such as those with special learning needs often struggle with such activities that dominate the learning of language including reading, writing, spelling and vocabulary (Council for Children with Learning Disabilities, 2004; Donaldson and Nash, 2005; Hardman, Drew, and Egan, 2005; Laurice and McCachran, 2003; LD Online, 2003; National Information Center for Children and Youth with Disabilities, 1997; Office of Disabilities Services (ODS) at Haverford College, 2003; Teaching LD, 2005). Limited English proficiency students (LEP) also encounter similar language learning problems, especially, in the single most important area of language development—vocabulary acquisition (Hardman, Drew, and Egan, 2005; Pikulski and Templeton, 2004; Schmitt and McCarthy, 1997; Waring and Takaki, 2003). Vocabulary acquisition is one of the most important components to

becoming literate and developing literacy skills (National Institute of Child Health and Human Development, 2000).

Vocabulary acquisition may become difficult for students with learning challenges as they encounter text with increasing readability difficulty and demands. Readability is very important for a reader gathering meaning. Dale & Chall (1949) defined readability as "the sum total of all those elements within a given piece of printed material that affects the success a group of readers have with it. The success is the extent to which they understand it, read it at an optimum speed, and find it interesting" (p. 23). DuBay (2004) cited several research studies concerning readability as salient today. These studies he cited from the 20th Century reported text with greater readability allowed the reader to persist in reading the content (cf. Feld, 1948; Hardyck & Petrinovich, 1970; Klare, 1974; Klare, Shuford, & Nichols, 1957; Murphy, 1947; Schramm, 1947; Swanson, 1948). To date, none of these studies included students with vocabulary learning challenges.

Vocabulary growth is typically measured by two facets: a.) words enunciated correctly and (b) correct understanding of word meanings. Instruction to develop reading vocabulary is most effective and beneficial for any learner, when it provides an intrinsic life motivating opportunity for him/her to develop vocabulary and construct meaning throughout one's experiences with language (Fosnot, 2005; Mathewson, 2000). Assistive technologies (ATs) may be one avenue for supporting vocabulary growth in students who struggle with learning language (Leu, 2000; Male, 1994; 1997; Molebash & Fisher, 2003; Vacca & Vacca, 2008).

Assistive technology (AT) has been defined by the 1997 reauthorization of the Individuals with Disabilities Education Act (IDEA) "as any item, piece of equipment, or product system, whether acquired commercially, off-the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability" (IDEA, 1997, p. 8). The pairing of AT with best teaching practices has proven efficacious for students with reading and other language learning issues. For example, in Gentry's (2006) study, the pairing of e-publishing assistive technology to trade books use was efficacious in enhancing content learning growth. Students with learning, writing, and reading issues gained in content growth within this study.   The use of trade books, technology, video, speaking, listening, and other forms of texts have the ability to improve the learning in content area classrooms (Sampson, Rasinski, & Sampson, 2003; Vacca & Vacca, 2005; 2008).   Victoria McLaughlin (2006) found interactive story reading with picture, visual support expanded English language learners Spanish as well as English vocabularies. Another best practice which is indispensible in classrooms today follows brain friendly, teaching research; it is the conveyance of choice (Silberman, 2006; Zull, 2002). AT choices, book selection, word selection, picture representation choices all represent the number of choices offered through the IDVDMATS approach. Students learning with assistive technologies benefit when such learning has a connection to best teaching practices (e.g., using trade books and choice) (Gentry, 2006; Sampson, Rasinski, & Sampson, 2003; Vacca & Vacca, 2005; 2008). Repetition of vocabulary words has proven to benefit English language learners (Galeano, 2006, McLaughlin, 2006). McLaughlin (2006) found children books to be a suitable platform for repetition with semantic context and picture support. Assistive technology paired with best practices may provide a means for repetition to be meaningful and not another exercise of drill and practice. Gaming is a new phenomenon which is used to facilitate repetition learning of vocabulary as meaningful and engaging (Richek, 2005). Recently, discovery learning and reciprocal teaching as best teaching practices have been heralded as relevant and needed in today's classrooms (Chak, 2007; Garderen, 2004; Richek, 2005; Schlenker & Tierney, 2006; Slater & Horstman, 2002). Slater & Horstman (2002) cited reciprocal teaching as the preeminent cognitive strategy fitting middle

school and high school struggling readers and writers. Similar to the above studies, this study involved elements of discovery and reciprocal education in regards to vocabulary discovery and the teaching of recently learned vocabulary to peers.

Research into reading attitude's connection to students with special learning needs is especially lacking and in need of further investigation (Lazarus & Callahan, 2000). Feiwell's (1997) research with second graders who have reading disabilities reported reading words ability as the best predictor of one's "academic self-concept" which was operationalized through "physical self-concept, social self-concept, and global self-worth measures from Harter's Self-Perception Profile for Children" (p.1; cf Harter, 1985). Therefore, using trade books to focus on certain words to provide opportunities for the direct reading of unknown words may prove to be a benefit for maintaining or encouraging a positive attitude toward reading among students who struggle with vocabulary acquisition. Attitude is an important component to learning vocabulary and reading perseverance especially for those students who struggle to gather meaning from text (Mathewson, 2000). The blending of reading books, AT, and other vocabulary acquisition instructional best practice methods may provided motivational opportunities for the creation of successful semioticians (meaning makers).

Purpose of the Study

The purpose of the study was to develop a method which merged best teaching practices with assistive technology support accompanying the use of student selected children's books to ameliorate vocabulary acquisition of unknown words discovered while reading. Also, the study sought to report the student's perceptions and reading attitudes before and after the lesson intervention. Readability scores from the student's text selections were reported. The following research questions guided this study:

- What learning perception does a student with learning disabilities and limited English proficiency manifest concerning reading instruction and personal reading experiences before the IDVDMATS?
- What learning perception does a student with learning disabilities and limited English proficiency manifest during and after the IDVDMATS instructional experience?
- What is the impact of IDVDMATS on the reading attitude of a student with learning disabilities and limited English proficiency before and after the lesson?
- What is the impact of IDVDMATS on the vocabulary acquisition of a student with both learning disabilities and limited English proficiency?
- Does a higher readability scores negate IDVDMATS potency for a student with both learning disabilities and limited English proficiency

METHOD

Study Instruments and Teaching Procedures

AT Device: *Franklin® Language Master 6000b™*
The Franklin® Language Master 6000b™ (FLM-6000b) specifications are varied. The average cost for this device is $107.00 USD. The FLM-6000b provides instant access to 130,000 words, 300,000 definitions, and 500,000 synonyms. It is an independent device which makes it portable and battery powered. The FLM-6000b includes the Merriam - Webster® dictionary. There are two models of the FLM-6000b: 6000b/6000SE. The dimensions of the device are 5 1/2 x 5 3/4 x 1 1/2 in and weighs 12 oz. The power can be by battery, 4 x AAA, or by alternating current (AC) via an AC Adapter Jack. The

FLM-6000b was designed to provide instant access to phonetic spell correction using ClariSpeech™ technology that is used for both words and definitions. An English grammar guide is included on the device to assist with grammar confusion. Twelve word games are available for students to experiment and play with language: Anagrams, Jumble, Word Builder, Flashcards, Spelling Bee, Memory Challenge, Hangman, Word Blaster, Word Train, Deduction, Word Deduction, Letris. A user list allows the user to save past words typed in the device for later study or game play with the twelve listed games above. FLM-6000b includes an 8-line display screen. The user controls contrast using a small wheel on the right side of the device marked by ◗. The FLM-6000b allows the user to adjust the font size. The device is designed to save battery power with automatic shutoff.   The FLM-6000b has computerized word say back function that is assessable using the "SAY" button. A headphone jack allows the user to connect and quietly use the computerized speech functions of the device. The volume control wheel is below the contrast wheel and allows the user complete sound control. A battery low indicator aids as a reminder to replace batteries.

Individualized Direct Vocabulary Discovery Method with Assistive Technological Scaffolding
The Individualized Direct Vocabulary Discovery Method with Assistive Technological Scaffolding (IDVDMATS) is a student centered approach that allows the student to have control and pleasure while learning. Control and pleasure are two needs a brain must have fulfilled to be productive and functioning (Zull, 2002). Before students are introduced to IDVDMATS, students must have experience with the technology to be used as prescribed by past research. The Institute for Research on Learning, warn, "The technology learning curve tends to eclipse content learning temporarily-both kids and teachers seem to orient to technology until they become comfortable" (Goldman, Cole, & Syer, 1999,. 5). Therefore, the student learned the functions and gained orientation experience while using the FLM-6000b before reading strategies in the IDVDMATS were introduced. Also, note the importance of the "I" (individualized) from IDVDMATS. Individulaization is as important as the technology or books used and is the ultimate best practice for students with special needs (Gentry, Fowler, & Nichols, 2007; Ryndak & Alper, 2003). The method below was adapted for students, like the participant in this study, with vocabulary acquisition problems who relied on visual cues to learn new vocabulary words. Also, the method was developed based on research and the information gained from pre student and teacher interviews as well as the student's prior knowledge and experience with technology.

LESSON STEPS:

Part 1- Reading & Finding Unknown Words

1.) The researcher and the student select a text (i.e., trade book) to read together in a read aloud.

2.) The student is asked by the researcher to find words he/she wishes to know more about as the researcher and/or student reads the selected text aloud.

3.) In accordance with the interactive reading activities design of pre, during, and after, the researcher plans the pair read aloud with prediction (e.g., "What does the title or picture on the cover tell us about the story we are reading today?"); Prediction and discussion occurred as needed.

4.) The student may stop the reading to point to a word that is unknown. The researcher writes the word on a small sticky note and places it on the page for quick identification of unknown words. A

discussion of the word may occur. The student may type in the word on the FLM-6000b to be defined and said aloud using the SAY key to compliment the discussion.

5.) After the teacher and student's pair reading activity has progressed for an age appropriate time, the researcher turns the pages of the text read with the student in the search for words of interest. The student with the researcher's encouragement selects words of interest. The researcher may guide the student to a word for consideration. The word choices should be words characterized by the student as limited or having no semantic understating. The researcher places a small sticky tab to mark the words for easy identification when reading through the second time.

6.) Once a word is selected, the student types in the word on the FLM-6000b to be defined and said aloud using the SAY key.

7.) The student reads the definition and uses the appropriate functions to have unknown words in the dictionary screen read aloud and/or defined as necessary. During this process, the researcher conferences with the student concerning his/her word selection and discovery.

8.) The student adds the word for later vocabulary game play and study using FLM-6000b LIST function key.

9.) Researcher point to the chosen words in the text. Remember that sticky tabs may be used to mark words. The researcher may not read the chosen words but asks the student to say the word and tell the meaning of the word. The researcher and the FLM-6000b assist when necessary.

Part 2 - SemanticVisual Representation and Guided Practice

10.) Visual representation is a process where the student and teacher select or draw pictures to represent the meaning of each word in the context of the definition from the text read. The teacher and student uses the LIST function on the FLM-6000b to track unknown words from the text read and finds the words in the text read using the sticky notes as a guide. The student draws or the teacher/student find pictures based of the context of the word in the text, the pictures provided by the text (if any), the definition from the FLM-6000b, and researcher/student interactive discussions (See Figure 1).
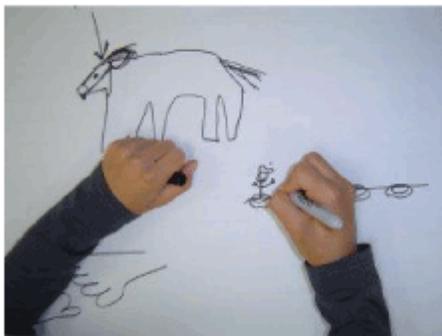
Figure 1. SD's drawing representation for the vocabulary word entrenched.

11.) After visual representation activities, the learner may engage in several guided practice activities. New learning may be practiced using several creative Learning Expression Choices (LEC): a.) sharing discovered word lists by playing one of twelve FLM-6000b games with a peer, b.) performing skits or tableau expressing word meanings for a peer to guess while viewing the actor student's word list on the FLM-6000b, c.) create a song or dance expressing the discovered word(s) and meaning(s), or d.) allow the student to express learning in his/her unique way. With LEC, the possibilities are endless.

12.) For a solitary guided practice activities and learning, the student may play one of 12 vocabulary games, study his/her word selections using the FLM-6000b LIST function for review, or review flash cards to match words to pictures selected or created during step ten. The student may review their list words and their definitions as well as their enunciations using the FLM-6000b.

13.) Steps two through twelve are repeated until all words are expressed visually.

Part 3 - Formative and Summative Assessments

14.) Formative Assessment: Using Power Point 2003 or other multimedia formats, researchers constructed games using the chosen vocabulary words for a student to match selected or drawn pictures in the context of a sentence from the text read to the correct vocabulary word. Researchers monitored the enunciation of the selected words as well as correct word matches. A student may use the FLM-6000b for help with definitions and enunciations (See Figures 2 and 3).

*Figure 2. **a**) (**left**) Photograph of the Franklin Language Master 6000b retrieved from http://www.franklin.com/estore/dictionary/LM-6000B/. **b**) (**top right**) The liquid crystal display illustrating the dictionary function of the Franklin Language Master 6000b for the word ominous. **c**) (**bottom right**) A slide from the formative assessment Power Point 2003 game illustrating the students picture drawing for caissons.*

Figure 3. A slide from the formative assessment Power Point 2003 game illustrating the Student's picture drawing for caissons and the illustrator's painting for caisson from the Last Brother: A Civil War Tale (Noble, 2006). This slide appeared when the student selected the correct hyperlinked word caissons from three words choices on a pervious slide.

15.) Summative Assessment 1: Using Power Point 2003, researchers construct a new story based on the book for a student to enunciate and to tell the researcher the meaning of each word after a reading is completed per slide. Enunciations and the correct defining of vocabulary words from new story were monitored. Unlike the formative assessment, pictures are found in the peripheral and not in a missing word blank (See Figures 4).
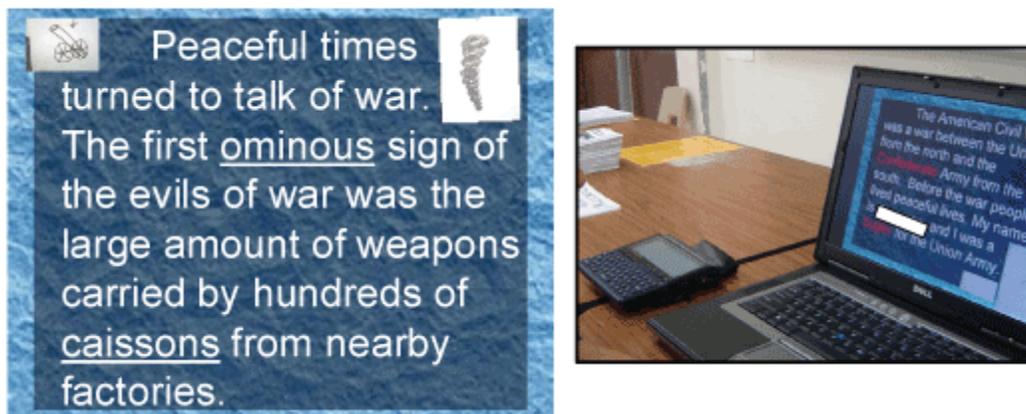

*Figure 4. (**Right**) A Power Point 2003 slide from the teacher created book utilized during summative assessment 1 and by using two vocabulary words with student generated picture drawings in the periphery. (**Left**) SD during summative assessment 1 read a Power Point 2003 slide which represented many slides from the laptop computer used which included two vocabulary words with corresponding picture drawings in the periphery. SD was the main character in the story. SD's name was omitted with a white box.*

16.) Summative Assessment 2: The Student viewed each word on 9.5'' X 11'' flashcards. As the researcher pointed to each card, the student enunciated the words and provided the definition of the words without text context, picture support, or the use of the FLM-6000b (See Figure 5). This was monitored.

Figure 5. One of the 9.5'' X 11'' flashcards used in Summative assessment 2.

17.) Summative Assessment 3: Using a paper story board sheets, the student constructed a written story as well as corresponding illustrations using the selected vocabulary words in a storyboard format. The student was asked to read the created story. Enunciation of the words and definition understanding s from oral explanations without the use of the FLM-6000b were evaluated (See Figure 6).
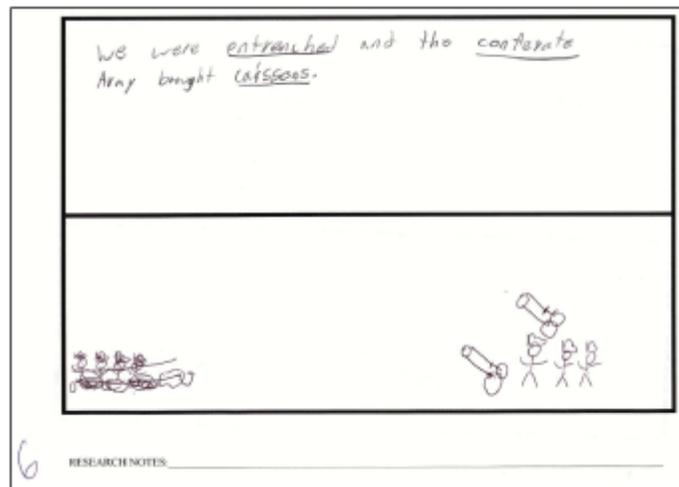

Figure 6. An example of a story board piece which SD placed as the sixth page of his story. He illustrated the story using picture drawing ideas from his previous vocabulary word drawings.

18.) Summative Assessment 4: the drawings from the student's created story were scanned and stored on a laptop for later use. The researcher typed the student's story and pasted corresponding pictures to Power Point 2003 slides following the student's story board (See Figure 6). The student used Power Point 2003, to make adjustments to the story (e.g., change wording, add clipart, add sounds, slide arraignment, etc…). The student shared the story as well as corresponding illustrations with the researcher. Enunciation of the words and definition understanding s from oral explanations without the use of the FLM-6000b were evaluated (See Figure 7).
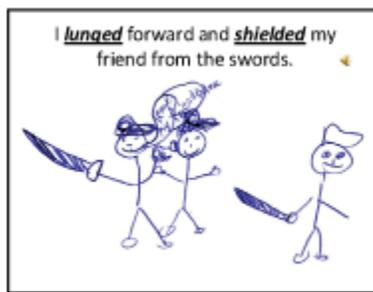
Figure 7. A Power Point 2003 slide representing SD's story using two of his vocabulary words. The sound of swords hitting each other constituted the sound effects SD chose for this segment of his story presentation.

19.) Summative Assessment 5: Using Power Point 2003, the student shared the story as well as corresponding illustrations with peers. The student explains the meaning of each word after reading sentence(s) per slide. Enunciation of the words and definition understanding s without the use of the FLM-6000b were evaluated (See Figure 8).

Figure 8. SD after he presented his new story to his class via Power Point 2003 and a data projector. SD's face, name, and picture were blotted out to maintain confidentiality.

20.) This whole process can begin again with the selection of a new book.

Design

This case study employed a descriptive design (Strauss & Corbin, 1990; Yin, 1993, 1994). Therefore, the case study operated in four phases: pre, implementation1, implementation2, and post. Following individual case study application procedures for a limited population of interest, one participant, SD, a student with learning disabilities and LEP, was selected by the school district for participation in the study (Hancock & Algozzine, 2006). The descriptive case study approach has been widely used and employed by special education researchers (e.g., Pyecha, 1988). Also, because little research addresses the use of assistive technology's blending with best practices to aid students with special learning needs in vocabulary acquisition, case study methodology was utilized and deemed appropriate by special education experts at Tarleton State University. Because case studies have traditionally been deemed by many scientists as unscientific or unsuitable, care was taken in developing the methodology (Hancock & Algozzine, 2006). Yin (1994) cited six data sources for case study research. All six sources are not

absolutely essential in every case study. However, a myriad of sources of data add to the reliability of a case study (Stake, 1995; Yin, 1994). The following are the six sources specified by Yin (1994): documentation, archival records, interviews, direct observation, participant observation, and physical artifacts. Following data source triangulation research ideology (Denzin, 1984), this study utilized all six sources specified by Yin (1994) to provide a vivid, descriptive picture of the student's learning experience in the framework of an interactive lesson methodology, the IDVDMATS approach.

During pre several interviews occurred. The student participates were directed, "Tell me about the times you have learned new words and definitions." Also, a question was asked, "What do you think could make learning new words and definitions easier for you?" The teacher was prompted to describe the the student as a learner and reader, and how the student learned vocabulary best. The student participant responded to the Elementary Reading Attitude Survey (McKenna & Kear, 1990). Once the pre phase concluded, the FLM-6000b was introduced.

Within the implementation1 phase, the student was introduced to the FLM-6000b's functions and uses by the researcher. Specifically, the student was taught how to use the dictionary, SAY, LIST, GAMES, navigation, and input functions of the FLM-6000b. A student may play with the device and ask teachers questions concerning device functions. At the conclusion of implementation1 phase, exit interviews were conducted. A single question relating to the FLM-6000b was asked, "What did you think the lesson today? Explain?"

During the implementation2 phase, the student used the FLM-6000b as the AT while following the IDVDMATS instructional method. After each day's work in the study in an exit interview, the student was asked, "What did you think about the lesson? Tell me about the lesson?" The student followed the steps of IDVDMATS from part 1 to part 3 as the study progressed. After the initial lesson as described in part 1, the researcher met ten times with SD. These meetings range from approximately an hour to an hour and 30 minutes. The meeting times depended on school and researchers' schedules. After each meeting, the researcher copied the vocabulary words from the FLM-6000b LIST feature onto paper as a record and for safe keeping of the data. An exit interview question was asked after each of the meetings, "Tell what you think about your work today?" The researcher probed for clarification as needed depending of responses from participants. Also, the book chosen had its readability evaluated.

The post phase of the study commenced once a reading was completed in part 1 and 2 of IDVDMATS. The student progressed from a formative assessment and five summative assessments using the word list generated on their FLM-6000b in part 3 of IDVDMATS. In the formative assessment researchers counted correct picture to word matches and correct word enunciations out of the total number of words. The student was allowed to use the FLM-6000b for help with definitions and enunciations (See Figures 2 and 3). Within summative assessment 1, researchers constructed a new story based on the book for the student to read. Enunciations and the correct defining of words were monitored per slide. Unlike the formative assessment, pictures were peripheral and not in missing word blanks (See Figure 4). Summative assessment 2 required the student to view each word on 9.5'' X 11'' flashcards. As the researcher pointed to each card, the student enunciated the words and provided the definition of the words without text context, picture support, or the use of the FLM-6000b (See Figure 5). This was monitored. Summative Assessment 3 allowed the student to use a paper story board to construct and sequence a written story as well as corresponding drawings using the selected vocabulary words. The student was asked to read the created story. Enunciation of the words and definition understandings without the use of the FLM-6000b were evaluated (See Figure 6). In summative assessment 4, drawings were scanned and stored on a laptop for later use. The researcher typed the student's story

and pasted corresponding pictures to Power Point 2003 slides following the student's story board (See Figure 9). The student used Power Point 2003, to make adjustments to the story (e.g., change wording, add clipart, add sounds, etc…). The student shared the story as well as corresponding illustrations with the researcher. Enunciation of the words and definition understanding s without the use of the FLM-6000b were evaluated (See Figure 7). In summative assessment 5, the student shared the story as well as corresponding illustrations with peers. The student explains the meaning of each word after reading sentence(s) per slide. Enunciation of the words and definition understanding s without the use of the FLM-6000b were evaluated (See Figure 8). After the student presentations, teachers were asked to describe their impressions of the vocabulary learning experience with AT.

In all assessments if the student does not enunciate the word correctly, the researcher provided the enunciation of the word for the student and had the student repeat it back. If the student did not know the definition, the researcher provided the student the definition. At the conclusion of the assessments, the student was handed the FLM-6000b and asked to review his word list using the LIST function. In an exit interview, the student was asked, "Why did you chose these words from your reading?" The researcher asked two final questions, "What do you think about reading books and finding vocabulary using (point to device) FLM-6000b? and "What did you think about how you learned new words from a book (point to book used)?" Also, the teacher was interviewed and asked to explain her thoughts, concerns, and ideas about the IDVDMATS. The learning disabled/LEP student participant responded to the final administration of the Elementary Reading Attitude Survey (McKenna and Kear, 1990).

Setting and Participant

The intermediate school which served grades 5 and 6 was located in a central Texas rural community. Student to teacher ratio ranged from 15 students to 1 teacher. The largest industries are dairy farming and a four year university. In the 2007 school year, the campus served 540 students. By ethnicity the following constituted the campus population: African American 1% (5.4), Hispanic 19% (102.6), Native American 1% (5.4), and Anglo or others represented 79% (426.6). Special education population represented 5.9% (32) of the population. Students with learning disabilities and those who were served with English as a second language services represented 5% (27) and 7.4% (40) of the total population, respectively.

SD was served as a student with learning disabilities and as an English second language learner. SD was a curious young man who voiced a love for school. He was Hispanic and valued his culture and Spanish language. SD spoke English fluently but had trouble reading and writing in English. SD enjoyed books about war history and weapons. SD was administered the 2007 alternative state developed test for reading and answered 75% of the items correct. His teacher referred to him as having a positive attitude toward learning. Continuing from teacher statements, SD's family valued education and supported the school's efforts to educate SD. SD had experience with using Microsoft software technology like the 2003 versions of Power Point and Word.

Data Sources

Quantitative Data Sources and Instrumentation
Vocabulary Word List. Vocabulary words and their corresponding definitions came from the words SD stored on his FLM-6000b list function area. The words were used through the IDVDMATS's lesson procedures.

Elementary Reading Attitude Survey. The Elementary Reading Attitude Survey (ERAS) (McKenna and Kear, 1990), also known by educators as the Garfield, is used to measure reading attitudes of children in elementary schools. The ERAS was designed for students in grades 1 through 6. The survey contains 20 questions which begin with, "How do you feel," introductory words. The students respond to the items on a Likert type scale with 4-point intervals. Students choose 1 of 4 pictorial representations depicting Garfield, a cartoon. Students select the character that matches their feelings. The Garfield cartoons' emotional expressions range from "very happy," "a little happy," "a little upset," and "very upset." The survey evaluates two separate areas of reading attitude: academic reading and recreational reading. Each area has 10 items.

McKenna and Kear (1990) surveyed over 18, 000 elementary students to determine validity for grades 1 to 6. Internal consistency ranged from .74 to .89 Cronbach alpha coefficients. ERAS construct validity for recreational and academic reading was determined by comparing students from various groupings. Using factor analysis and score comparison, researchers determined construct validity for each subscale of the ERAS. Survey testing produced significant differences (p<.001). Recreational reading attitude validity was determined by comparing scores of students: with library cards (mean=30) versus without library cards (mean=28.9), checked books out from the library (mean=29.2) versus did not check out library books (mean=27.3), and less than one hour of television a night (mean=31.5) versus more that two hours of television a night (mean=28.6). Furthermore, academic construct validly was determined by comparing scores of high ability readers (mean=27.7) with the scores of low ability readers (mean=27.0). As an indication of reliability and validity, numerous studies (Bottomley et al., 1999; Kush & Watkins, 1996; Lazarus & Callahan, 2000; McKenna et al., 1995) have used ERAS as a measure of reading attitude.

Scoring ERAS is determined by student responses. The point values ranged from 1-4: 4= "very happy," 3="a little happy," 2="a little upset," and 1="very upset." Students have a possibility to score a maximum of 20 points and a minimum of 10 points per subscale (i.e., recreational or academic). A total score combining both subscales exerts a maximum of 80 points and a minimum of 20 points. The higher the score on individual subscales and the subscales total combination the more positive the score's measure.

Readability Matrixes. Each text was evaluated for readability using three established measures: Gunning Fog Index (GFI), Flesch Reading Ease Score (FRES), and the Flesch-Kincaid Grade Level Score (F-KGLS)(Kincaid, Fishburne, Rogers, Chissom, 1955; Flesch, 1946, 1948, 1949,1960; Gunning, 1968). Although the researchers of this study do not agree with all the philosophies behind such formulas (e.g., shorter sentences are always better), these formulas do offer an indication of difficulty for a reader when comparing texts (Weitzel, 2006). DuBay's (2004) synthesis of research asserted readability formulas as well researched and proven as a valid/reliable means to compare texts' readability according to a standard. Please note—it is not the philosophy of the researchers in this study to match texts with students based of readability scores. Students reading text with difficult words or longer sentences benefit learners with appropriate scaffolding from significant others (Fountas & Pinnell; 2006).

The Gunning Fog Index (Gunning, 1968) like the Flesch-Kincade Grade Level Score (Kincaid, Fishburne, Rogers, Chissom, 1955) indicate the number of years of education required to understand the text. The Flesch Reading Ease Score does not provide a grade level but offers an interval scale to measure readability. For example, the text which scores closer to 100 is considered easier to read.

Qualitative Data Sources

Student Oral Interviews. Oral student semi-structured interviews occurred in pre, implementation1, implementation2, and post phases of this study.   Interviews were videotaped and dialogue was transcribed to serve as a record of SD's experiences and perceptions.

Researchers' Observations and Field Notes.   Supporting data sources included the researchers' observations and were recorded in field notes. This was not be systematic and occurred when the researcher noted something considered deserving of further inquiry or observation.

Story Board and Student Edited Power Point Creation. The story board creation depicting a unique storyline using the 18 selected words and the Power Point 2003 depiction of said story with added sounds allowed a view of the student's interactive story making capabilities. These artifacts provide tangible evidence representing SD's progress through the IDVDMATS approach .

Data Analysis

Quantitative Data Analysis

Vocabulary Growth Analysis. Vocabulary growth is specifically defined as the number of vocabulary words enunciated correctly in the post phase assessments out of total discovered words on each of the FLM-6000b student's generated vocabulary list created during implementation2. Also, vocabulary growth includes the number of word meanings correctly stated or expressed out of total number of word meanings on each of the FLM-6000b student's generated vocabulary list. Once frequency counts are completed, descriptive statistics were calculated and reported for enunciations and word meanings per assessment. A total vocabulary growth score combined the frequency count of vocabulary words enunciated correctly (WEC) and the frequency count of correctly stated word meanings (CSWM) from all assessments (i.e., formative to summative assessment 5). Continuing, a total vocabulary growth was calculated by the combined frequency count sum of WEC and CSWM (i.e., ΣWEC + ΣCSWM) which was divided by the total number of opportunities to enunciate (OE) and state meanings (OCSWM) of SD's selected vocabulary words into a single score. This score was labeled total vocabulary growth score (TVGS). The formula for this calculation read: $\{((\Sigma WEC + \Sigma CSWM)/(\Sigma OE + \Sigma OCSWM)) = TVGS\}$. The TVGS provided the percentage of combined correctly enunciated and correctly stated meanings total sum from the total sum of opportunities given a student to enunciate and state meanings of vocabulary words correctly. Therefore, the WEC, CSWM, and TVGSs for SD were reported. The numbers of correctly enunciated and defined words from formative to summative assessments were utilized. Frequencies and percentages were reported.

Elementary Reading Attitude Survey Analysis. The learning disabled/LEP Student's reading attitude scores were calculated from the ERAS pre and post surveys (McKenna & Kear, 1990). Gain and loss scores from pre to post were computed. From attitude surveys, a student may produce scores in three reading attitude ranges as follows: Recreational Reading Attitude (1-10), Academic Reading Attitude (1-10), and a Total score (20-80). A student with total reading attitude gain/loss scores below 41, between 41 to 50, or 51 and above were categorized as having negative, indifferent, or positive reading attitude ratings respectively. Descriptive statistics were generated.

Text Readability Analysis. The book chosen by the SD was evaluated using three readability formulas: GFI, FKGLS, and the FRES. Following the requirements for each readability algorithm, sentences were analyzed from three general areas in each text: beginning, middle, and end. Scores were obtained for

each readability formula for the chosen text. Whole pages of text were analyzed per beginning (first three pages), middle (three pages from the center), and end (last three pages of textual story). An average from the beginning, middle, and end of the each text were computed for each readability formula, respectively. Descriptive statistics were reported.

Qualitative Data Analysis

With the desire to provide the research participants with a voice, grounded theory, phenomenological, and case study traditions' elements were used to glimpse the whole picture of the socially constructed process called vocabulary learning (Feagin, Orum, & Sjoberg, 1991). The natural setting takes preeminence over all forms of research for educational social scientist eager to discover practical solutions for the complex learning issues teachers experience in today's classrooms; hence, interviews, observations, artifacts, and archival records provided the medium to view this complex and at times incoherent view (Berg, 2004; Creswell, 1998; Marshall & Rossman, 1999,Yin, 1994).

Interviews, Perceptions, Field Observations, and Artifacts Analyses. Interview data were collected from SD through open ended semi-structured oral exit interviews which progress from pre, implementation1, implementation2 (parts 1&2), and finally post (part 3). All interviews and field experiences were recorded using an audio recorder and at times a video camera. Artifacts were photographed or digitally scanned for comparison descriptive analysis with field note observations, student/teacher field experience recorded statements, and interview data. The data was analyzed using Yin's (1994) general analytic strategy techniques of pattern-matching (Trochim, 1989) and explanation-building. Therefore, the analysis was based on the theoretical underpinnings which led to the case study. Also, to further enhance the study's validity, a descriptive frame work in the structure of a lesson method, IDVDMATS, was utilized to provide rich details of the participant and researchers use of assistive technology blended with best practices to enhance vocabulary acquisition of students, like SD, with special vocabulary learning needs. The goal of this case study was to provide a

Findings/Results

The findings and results were reported in the framework of the IDVDMATS lesson. This lesson framework provides an organization to report with rich description the phenomena of IDVDMATS as experienced by SD, a student with learning disabilities and limited English proficiency. The following is a sampling of SD's experience.

Pre Phase: Before IDVDM -ATS
SD's Pre Interview. SD's responses to both pre questions were quick and short. He was quiet and reserved and answered in a whispering voice with a barely audible tone. This interview occurred in one meeting.

Researcher: Tell me about the times you have learned new words and definitions?

SD: I like to learn new words. When I remember new words, I feel good.

Researcher: What do you think could make learning new words and definitions easier for you?

SD: The pictures in my eyes…told me about words before. One time I forgot a word the teacher wanted us to know about. I asked her what the word is and said it a lot to remember it. I made what the word means in my words.

Researcher: What do you mean when you say "pictures in my eyes?"

SD: I see the word doing…word is there in a way to do…I see it a lot.

Teacher's Pre Interview. The teacher responded to two requests. The teacher described the student as a reader and explained how the student learned vocabulary best.

Teacher: SD is a strong reader as far as resource class. He is close to being on level. Oral reading and sight words are strong. Vocabulary knowledge is weak and a struggle. In the context and brainstorming in small group discussions…Visual cues work well. He works hard to do his best…It is pictures for him while he learns new words. He can put pictures on the computer for discussion and writing (The teacher was referring to Word and PowerPoint 2003).

Implementation1 Phase: Learning How to Use the FLM-6000b
Introduction and Practice Using the FLM-6000b. SD was shown the features of the FLM-6000b by the researcher and allowed to explore the uses of the device using words SD chose. The speech feature was understandable to SD when SD used words he already knew. However, when he typed in words he did not know from reading materials found on the teacher's desk, he had to listen to the word several times using the SAY function to understand the pronunciation. The researcher helped the student understand the pronunciation of one of the three misunderstood words pronounced using the synthesized speech function. Also, the definition of each word was explored. SD had difficulty reading and understanding two of the words' definitions during the FLM-6000b introduction. SD thought aloud as he tried to understand the definitions. For example, using one of the words he found on a piece of paper, SD began unprompted self and student to researcher dialogue. I encouraged this behavior as the research project continued.

SD: There the word is…I know the say of it (He pushed the SAY function key to hear the word and he says the word immediately) ... Assessment…Which definition is it? (Looking at the researcher for a response).
Researcher: There are four of them. They can all be true…

SD: How do you know the one (He points to the screen)?

Researcher: The word assessment means different things…It depends on …

SD: I remember…It means…from the other words and sentences with it to help me know it.

Researcher: Yes…the fancy word for what you are describing is called using context clues. Using the words and sentences around a word to help know what the word means helps us.

SD: How do I do it without it being with other words? It is on the paper (pointing to the paper on the teacher's desk) all by itself here…I need more words to know it.

Researcher: SD, you are right. This is hard without more words or what I say is needed is context…

SD: contestant clues!

Researcher: context clues…

SD: context clues…context clues…I knew it.

SD typed and entered words in the FLM-6000b while communicating his thoughts and ideas aloud about the device and his past experiences with words he had learned. Similar dialogue expressions like the previous example above followed other word experimentations using the FLM-6000b. During the session SD asked about the different functions of the device. At times he sought hints or reminders from the researcher concerning the varied functions of the FLM-6000b. As time passed, he asked fewer questions as he typed in words from around the room, the teacher's desk, and from his memory.

SD's FLM-6000b Use Interview. After the experience with the FLM-6000b, the researcher asked one question. What did you think about using the FLM-6000b (researcher pointed to device)?

SD: Think it is good to help me learn new words. I liked the game hangman with the word bird. I won it. I want to learn it more.

Researcher: What more do you want to learn about it (pointed to FLM-6000b)?

SD: I want to know it more and the words I need to get…I like it.

Implementation2 Phase: During IDVDM-ATS
Part 1- Reading & Finding Unknown Words. This phase extended into three meetings which total time summed to three hours and thirty minutes. SD expressed an interest in war history and battles. After reviewing several books, SD decided on a book about the civil war entitled, The Last Brother: A Civil War Tale (Noble, 2006). The average readability scores for the book placed the text above SD's grade level: GFI 8.82, FRES 78.19, and FKGLS 6.26. Although the book is stationed above SD's grade level with moderate reading difficulty, SD's high interest with the book selection outweighed any score.

Through paired, interactive reading, several words were discovered as problematic for SD in both enunciation and definition meaning. SD did not know the enunciations and the definitions of the following 18 words: bugler, dozed, outflanked, skirmishes, bayonets, battalions, brigades, regiments, entrenched, confederate, caissons, bombardment, ominous, reins, lunged, shielded, twilight, and etched. Each definition found in the FLM-6000b proved difficult to read for SD. SD scanned the book where the word was found and looked at the pictures as well as surrounding sentences to understand the meaning of the word in the context of the story. After reviewing the text, SD could understand the definition provided in the FLM-6000b. This was a time consuming process. The longest time spent on defining a word from the book was 17 minutes. The word confederate proved the most difficult. For example, the definition in the FLM-6000b read, "**1.** United in a league: Allied [or] **2.** Of or relating to the Confederacy." SD did not know the words united or allied. Also, SD did not know Civil War history well. However, SD used the FLM-6000b to define allied and united. He chose the following as possible definitions respectively, "[united] **1.** made one and **3.** Being in agreement…[allied] **2.** Having a family relationship." After reviewing the FLM-6000b's definitions and the book's pictures of the two opposing armies with supporting sentences containing confederate, SD came to the meaning. As he went through this process, the researcher asked SD to talk out his thoughts or think aloud. The following is an excerpt of SD thinking aloud about the meaning of confederate:

SD: It says [concerning united] made one or agreeing on something…[concerning allied] It says being family…[He presses the SAY key to hear the word confederate] confederate…confederate… They are

a family? [SD looks at the books pictures and read the sentences with confederacy in it.] The problem in the Civil War was that the Confederate Army had the same calls. The Confederate Army is one side who agrees with their side and the Union Army [Union Army was from a different part of the book.] wore blue and that is the side Gabe [main character in the story] was on…the Confederate Army…gray…The Confederate fought the Union side as one fighting army. I hope Gabe is not hurt by the confederate Army; he is on the blue side.

Researcher: Good work SD…Let's see what happens next. So Gabe is on the blue side, the Union…What is going to happen?

SD: Will he get hurt? He is just playing a horn. He is going to a war battle.

Researcher: Well…we can find out by reading more… [The process continued.]

The average time for all 18 words was 5.2 minutes. The longer it took to define a word, the longer it took to reorient back to reading the book. After looking up confederate and using the FLM-6000b, the researcher labored to help SD get back on the story line using the interactive reading approach (Fountas & Pinnell, 2006). SD wanted to know what was going to happen to Gabe and constantly asked about other characters and a horse's well being from the story.

The SAY function proved easier to use for SD. After he typed an unknown word in the FLM-6000b, he was able to pronounce it. However, he pressed the SAY key two to three types per word before enunciating each word. His ability to use the FLM-6000b improved with each use. After the word confederate, SD did not ask any more questions about how to use the FLM-6000b. He used it without asking what button to press next or what screen is currently being viewed.

Part 1 - During Exit Interviews. SD began to talk more as he became more familiar with the book and the assistive technology device. He shared the following at the closing of the three meetings during this phase in response to the same exit interview question: "What did you think the lesson today? Explain?"

SD (*Meeting 1*): It was good. I liked to find out the word bugler [Also, went to the word on his list and pressed say to hear it.]. The black computer [FLM-6000b] is neat to find words and tell them out to you. I know the words faster and don't have to look in a fat dictionary book.

Researcher: Why do you not like the dictionary as a book?

SD: I don't know how to spell it and I get lost in it…I end up asking someone anyway. I will just ask the black computer. It not only helps me spell it but says it so I can know it. I am just faster to use it.

SD (*Meeting 2*): I liked learning the word outflanked. This means you are in trouble because the enemy soldiers, like the gray to Gabe, could get you. Confederate was a hard word. I am glad not all the words were like that. I had to learn [define] words in the screen using it [SD points to the FLM-6000b.] to get the first word I typed from the book. I want to type all the words I don't know to get when I need to remember them in class.

SD (*Meeting 3*): The word ominous is something about to happen that is bad…evil. I think it is like when I see the tornado that came and the sky is dark and scary. If the tornado hits, we could get hurt… I have eighteen words on my list [SD presses the LIST function and points to the screen on the FLM-

6000b.] I like the list because I know the words I need to learn to know the story [SD began to press the SAY key to hear some of the words from his list]…I like the thesaurus. I did know about a screen [SD is referring to the thesaurus screen function on the FLM-6000b.] that gives you same and not same words for a word. I used the thesaurus screen to get the word skirmish…I knew that short conflict with military means to fight.

Part 2 - SemanticVisual Representation and Guided Practice. SD preferred to draw pictures which tell the meaning of the words from the book read. Using the FLM-6000b's LIST function with support from the book's pictures and surrounding sentences or words, SD began to draw pictures which go with the each word's meaning (See Figure 1). The dialogue between SD and the researcher as well as SD's think aloud illustrated the thinking as SD drew. Part 2's duration occupied two meeting times. The following are excerpts from his drawings of confederate and ominous, respectively.

SD (*Word - confederate*): What can I draw for [SD presses SAY function to hear confederate.]…confederate…confederate …

Researcher: What does it mean?

SD: Means family or being one on something…They were different that the blue…they wore gray and fought the Union. Orlee was a Confederate bugler [Orlee was a southern boy who meet Gabe in the woods. They became friends in the story. SD found Orlee in one of the book's illustrations and pointed to it]

Researcher: What will you draw?

SD: I will draw Orlee…no I will draw agreement… That is what confederate means. I will draw two hands shaking like they agree. You know this could be a picture that shows the Union…the blue were agreeing to fight the gray side.

SD (*Word-ominous*): [SD types the word ominous in the FLM-6000b and presses the SAY function key to hear the word.] Ominous…ominous…The tornado is a bad sign…ominous… of bad to come…fortune teller of evil to come…[SD made wind sound as he drew the tornado representing the word ominous.].

Researcher: What will you draw to represent ominous?

SD: I will draw a tornado…I guess that's all…

For more practice with SD's chosen words after all the drawings were completed, SD decided to forego the LEC ideas and engage in a solitary guided practice activity using the GAMES function on the FLM-6000b. SD played hangman with the words. SD was able to guess ten of the words with two to three letter hints.

Part 2 - Semantic Visual Representation and Guided Practice Exit Interviews. SD was asked, "What do you think of the lesson?" after the two day drawing exercise. SD responded with the following statements…

SD: I like the drawing and practicing the word with the SAY [SD pointed to the SAY key on the FLM-6000b.] I want to do this with my other words.

Researcher: What other words?

SD: Not the words from the war book….The words in science class could be knowed [sic] to me…

Researcher: What did you like about drawing the pictures?

SD: I liked…liked…I don't know…. I liked knowing it with one thing [SD pointed to his picture representing etched, one of the last pictures drawn. He was referring to the picture as holding the meaning to the word as one object.]… It is easier to do it like that.

Researcher: Did you find anything hard about the picture drawings?

SD: yes.

Researcher: Tell me about it.

SD: The words confederate and ominous were hard to do pictures for…. They were words without something…I had to make it something to be a drawing for the word…. I knew the word and thought of the drawing picture to make.

Part 3 - Formative and Summative Assessments: Post IDVDM- ATS
Formative Assessment. The researcher created a game based on student and teacher's input. Both the teacher and the student used sound to express vocabulary word meanings with action. For example, SD mimicked a wind sound when drawing the word ominous and relating it to a tornado. The teacher often associated sounds with stories, poems, and words to clarify meaning. For example, in her unit concerning pioneer life, she vocalized a scraping sound as she described the process of husking corn. The researcher found sounds on the internet (http://www.findsounds.com/) relating to the 18 words. These sounds played when SD chose the correct vocabulary word. All of SD drawings and some of the illustrations from the book were scanned into the computer as jpeg files and placed in Power Point 2003 slides with sentences directly out of the text which used the vocabulary words. SD was instructed to read the sentence and select (click) the correct vocabulary word from one of three vocabulary words represented by hyperlink buttons at the top of the slide. A blank space occupied by a picture clued the student to what word was needed (See Figure 2 and 3). SD was able to match 16 of the 18 words with pictures. The two words he could not match were confederate and lunged. Also, these two words proved difficult for SD to enunciate and state the meanings. SD looked at his list on the FLM-6000b and retrieved the two words definitions and enunciations. Once he reviewed the two words on the FLM-6000b, he was able to enunciate and correctly match pictures to vocabulary words.

Summative Assessment 1. The researcher created a story using the 18 words in the same context of the original story following a similar story line. In this version, the researcher made SD the main character. From the reading of the new story created by the researcher, SD was able to enunciate and state word meaning during and after slide readings (See Figure 4).

Summative Assessment 2. SD was able to enunciate 17 words correctly. However, the meanings of two words were confused. SD mixed the meanings of ominous and bombardment and was unable to

enunciate skirmishes. Once the assessment concluded, the researcher placed the pictures representing the three confused words before SD. Also, SD used the FLM-6000b to review his list and found the three words giving him trouble with the meanings or enunciation. SD pressed the SAY key to hear the words and used this same function within the definition portion to hear certain words. After the picture and FLM-6000b review, SD immediately knew the meanings and was able to enunciate skirmishes. He expressed the following during this exercise.

SD: I see them…bombardment is just a cannon shooting cannon balls. Ominous is the coming of the tornado [SD makes wind noise with his mouth.].

Researcher: I noticed you were able to pronounce the words but had trouble with these words' meanings. What do you think about that…what happened?

SD: I forgot about the tornado picture and saw the cannon balls coming down to hurt people. The cannon balls coming are… hurt to come to you. I see now…. I thought…the cannon balls are coming. Bad things are coming. They [cannon balls] were [SD presses the SAY function key on the FLM-6000b on the word THREATENING which is found in the definition of ominous (See Figure 2). After hearing the word, SD pressed enter on this word to see the definition of THREATENING (See Figure 9).]. You see…threatening means warning….
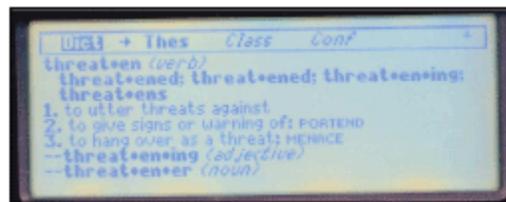

Figure 9. The definition for threatening using the definition function of the Franklin Language Master 6000b.

SD: Skir…[SD pressed the SAY function key on the FLM-6000b to hear the word.] Skirmishes…that's that fighting word called [pressed Say key to hear words again] skirmishes…They use the bayonets to skirmish with each other in the Civil War.

Summative Assessment 3. Of the assessments, this was the most time consuming—involving two meetings. SD used the flash cards from summative assessment 2 to begin his story using the 18 words. After he used a word or several words on a story board page, he drew an X on the flash card containing the word used. He wrote sentences using all the words and drew pictures illustrating the action in the story. Some of the pictures used were similar to the ones he drew for certain words (See Figure 6). He correctly used each word following the newly learned definitions. SD followed the story line of the book and researcher's story. Like the book and the researcher's story, SD pursued the Civil War theme. As SD wrote, he arranged and rearranged the words and rewrote sentences to create a story in logical sequential order. This seemed to be natural for SD. He said, "I like the story I know and the one I can do too." Similar to the researcher's story, SD placed himself as the main character. SD portrayed himself as a bugler; however, he as gave himself a fighting role and that of a hero who saved the life of a fellow soldier (See Figure 10). The ending of his story was similar to the original book and the researcher's story (See Figure 11). After SD completed his story and arranged it in the order he felt was appropriate, he read it to the researcher. SD enunciated and correctly used all 18 words in his story.
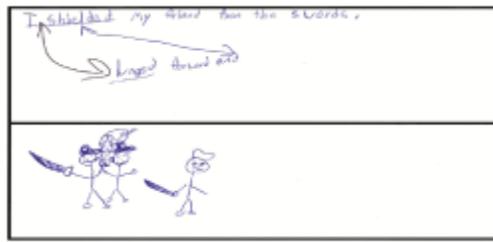
Figure 10. A page from SD's story board during summative assessment 3 in which he assigns himself the persona of a hero who saves a friend from danger.
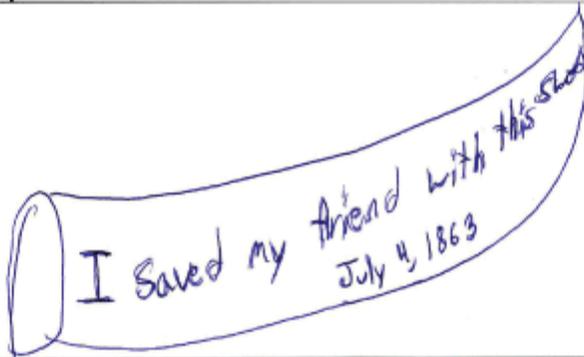

Figure 11. From top to bottom, the Power Point 2003 slides created by the researcher during the summative assessment 1 and summative assessment 4, respectively, followed the same ending to the story from the mentor text used, The Last Brother: A Civil War Tale (Noble, 2006). The slide had a sound of etching in the background as represented by the speaker icon.

Summative Assessment 4. The pictures and sentences were placed in the order specified by SD in summative assessment 3. Changes were not made to the story sequence or story line. SD wanted to place his picture on the first slide, and he wanted peers to hear him say, "What's up!" Therefore, the researcher photographed SD with a digital camera and recorded him saying, "What's up!" These were placed in the first slide of SD's story. SD became enthralled with sound. SD's asked if some of the sounds from the game during the formative assessment could be used in his story. This process progressed for two meetings. For example, the sound of someone snoring was used with the word dozed just as it was used in the formative assessment upon a correct response. The researcher and SD listened to sounds and placed them where SD specified in his Power Point 2003 story. In some of the slides SD wanted his voice to be used. For example in the slide where he used three similar meaning words (brigades, regiment, and battalions) his voice pops up saying, "Are you ready guys?" (See Figure 12). Also, the researcher allowed SD to choose sounds from a sound search internet site (http://www.findsounds.com/). Once completed, SD read his story to the researcher. All 18 words were enunciated and had meanings correctly stated.
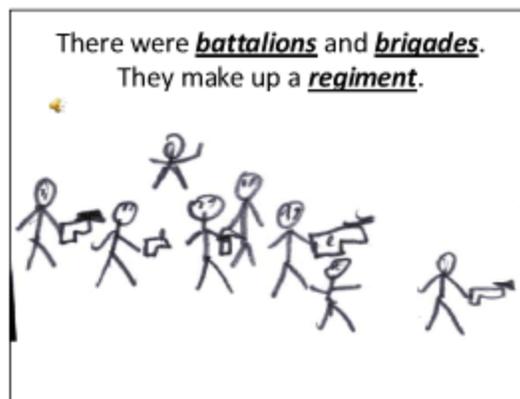

Figure 12. A Power Point 2003 slide from SD's book using three of the 18 vocabulary words. The 🔊 icon is the recording of SD saying, "Are you ready guys?"

Summative Assessment 5. SD presented his story via Power Point 2003 to his fellow students, teachers, and principal within his special education language arts resources class. After the sound effects subsided on each slide, SD read the story. After reading, SD enunciated the vocabulary words and explained the meanings per slide. His peers clapped and laughed when they heard the sounds, and SD laughed with them. He enunciated and correctly explained the meanings for all 18 vocabulary words in his story. After this exercise, spontaneously, students began to ask SD questions:

Student 1: SD, how did you do the sound and pictures on the computer?

SD: I put them in with Dr. Gentry from the internet, and we had pictures I drew put in the computer to use.

Student 1: I want to do it next….

Student 2: I like the story SD. How did you know to write it?

SD: [Holding up the book, The Last Brother: A Civil War Tale (Noble, 2006)] I looked at this one….I liked the Civil War.

SD's Post Interview. SD responded to three questions, a)Why did you chose these words from your reading; b) What do you think about reading books and finding vocabulary using (point to device) FLM-6000b; and c) What did you think about how you learned new words from a book (point to book used)? The following is an excerpt of the responses to the questions above, respectively.

SD(a): I did not know them before I read them. I wanted to know what they meant and what they said for the story…. I liked the book and need the words… to know it.

SD (b): The computer [FLM 6000b] helped me. I liked having a place to go and see the words I need to know [SD is referring to the LIST function on FLM-6000b.]…When I could not say it or see it [recognize it], I could press SAY, and I heard it said… The only thing hard were some of the words tell what the word meant. Sometimes I had to look at other words [SD is referring to using the FLM-6000b to define words in the definition of other words or the use of the THES or thesaurus function to find the meanings of unknown words.] to know the word…. I want to use it in other classes and other books to know their words. I think I will like that…Sometimes I could not tell what the word was and had to push the SAY button to keep hearing it. I was able to get it, but I wish it [SD pointed to the FLM-6000b] sounded like me [SD pointed to the speaker grid on the FLM-6000b]…need it to sound better to really get it in one time.

SD (c): This was the best story I read and know the words. I like the time to know the words and the games I played with the words on hangman. I hope I can do it again… all my friends in class now wish they were me…. I can read a new book and know how to find out what some words mean. I think I will do it once you give the computer to Mrs. BV…. She told me I could teach her and the class how to use it.

Teacher's Post Interview. The teacher reported positive results as well as concerns with the IDVDM-ATS process. The teacher expressed that SD enjoyed the project and the one-on-one instruction. She described his self-efficacy about learning new words as improved and evident as he learned new words in class. The only concerns she expressed related to the availability of the technology (FLM-6000b, computers, and Power Point 2003) for staff and students to have the time to learn and then apply it to vocabulary learning.

Teacher: SD enjoyed his project…He seemed to not only improve vocabulary and comprehension, but also confidence as he shared his accomplishments with adults as well as peers. He enjoyed using technology along with the book and was enthusiastic about the outcome of this project…. I hope we can do this…but we do not have a large amount of time we can spend in the computer lab.

SD's Elementary Reading Attitude Survey: *Pre & Post*
SD's ERAS (McKenna & Kear, 1990) raw scores with corresponding percentile ranks for pre and post were 35/87, 36/91 recreational; 36/96, 37/98 academic; and 71/95, 73/97 full scale, respectively. SD produced a 4 point percentile rank gain in recreational reading attitude, a 2 point percentile rank gain in academic reading attitude, and represented a full scale gain of 2 percentile points between pre and post survey administrations. According to the ERAS, SD had a positive reading attitude during pre and post administrations.

SD's Vocabulary Growth Measure from Post Assessments of IDVDM-ATS

SD's TVGS was 96.76%. SD was provided 108 opportunities to correctly state vocabulary word meanings and vocabulary word enunciations. During the formative assessment SD enunciated and correctly stated definitions for 16 of the 18 words. Summative assessment 2 proved to be a challenge as well with 17 words enunciated correctly and 16 words' meanings correctly stated. The remaining summative assessments reveal 100% correct enunciations and stated words meanings (See Table 1).

Table 1

SD's Vocabulary Growth Measure from Formative to Post Assessments of IDVDM[ATS]

Source	WEC	CSWM	OE	OCSWM
Formative	16	16	18	18
Sumative1	18	18	18	18
Sumative2	17	16	18	18
Sumative3	18	18	18	18
Sumative4	18	18	18	18
Sumative5	18	18	18	18
∑ of Assessments Totals	105	104	108	108
(∑WEC+∑CSWM) & (∑OE+∑OCSM)	209		216	
TVGS (209/216=)	96.76%			

SD's Vocabulary Growth Measure from Formative to Post Assessments of IDVDM-ATS

Note. WEC= count of words enunciated correctly, CSWM =count of correctly stated word meanings, OE= count of opportunities to enunciate vocabulary words, OCSWM=count of opportunities to state vocabulary word meanings, ∑=sum, and TVGS=total vocabulary growth score.

LIMITATIONS

The limitations are acknowledged to give the research consumer the ability to decide the level of trustworthiness and level of situational likeness to assign given findings and conclusions. Each student may interpret the IDVDMATS differently. The prior level of expertise using technological learning tools may impact study results. The IDVDMATS is not a fixed, stagnant lesson approach but is a framework to individualize instruction using AT tools for vocabulary acquisition. Therefore, application of such an approach with diverse students may have differing results. For instance, a different choice in LEC activities within IDVDMATS could change vocabulary learning outcomes. SD had a good attitude toward reading before the research project. A student with a poor attitude may not fare as well using this instructional approach.

DISCUSSION

A guiding philosophy for teachers working with students who have special learning needs can be summed with this statement, "Turn weaknesses into strengths and use strengths to overcome weaknesses." All that remains with such a philosophy are strengths. A philosophy like this energizes teachers to adapt and individualize instruction like a medical doctor would a prescription or a procedure to fit the individual patient's needs. The first step to do this is getting to know your student. One axiom or law should guide educators in all they do and say-Know Thy Student (KTS)! This study sought to do just that. From pre student interviews, teacher interviews, and past research with students who have

special learning needs, researchers learned SD may learn vocabulary best from trade books of interest, allowing choices, interaction with technology, pictures representations, and repetition of unknown words in an interactive format. Thus, IDVDMATS was born with a mixture of past research knowledge, KTS, AT, and best practices. Although an approach like IDVDMATS is time intense, it is time well spent if the time allows a student to experience authentic literature and vocabulary concept learning in an interactive, interesting manner.

CONCLUSIONS

Readability, Attitude, and Interest: The Choice
SD's chosen text, The Last Brother: A Civil War Tale (Noble, 2006), was above his readability level according to the GFI 8.82, FRES 78.19, and FKGLS 6.26 ratings. SD's interest in the book with his good attitude toward recreational and academic reading combined with the IDVDMATS approach transcended the challenges SD faced as a student with learning disabilities and limited English proficiency (Mathewson, 2000). Readability is only one factor to consider when students select books to read. SD's interests were the prime concern for this study. One could argue that readability is a problem if the student has no interest in what is read (Dale & Chall, 1949). SD expressed his preference about learning new vocabulary best, "I like to learn new words. When I remember new words, I feel good." This strength capitalizes the learning experience when supported by a good attitude, interest, and choice (Dale & Chall, 1949; Feiwell, 1997; Mathewson, 2000; Silberman, 2006; Zull, 2002).

IDVDM-ATS = SD Learning Vocabulary
Individualization of vocabulary instruction can transpire if a teacher ascribes to KTS philosophy and actively pursues the best course of action for an individual. This study upheld the benefits of blending several best practices proven from past research with AT as central in aiding students, like SD, to generate meaning from text. For example, allowing students to chose their text; choice allowed in discovery learning of unknown concepts like vocabulary; interactive learning through AT games and children trade books; interactive repetition of concepts with the FLM-6000b's dictionary, say, and thesaurus functions; and interactive pictorial representation of concepts via large paper drawings and Power Point 2003 technology which utilized Internet sound resources, trade book illustrations, and student digitalized drawings all became the interactive mainstay of the IDVDMATS approach specifically designed with SD's strengths in-mind (Male, 1994; 1997; McLaughlin, 2006; Richek, 2005; Silberman, 2006; Vacca & Vacca, 2005; 2008; Zull, 2002). In summative assessment 5, SD became an author of his own story using the vocabulary he did not comprehend at the beginning to teach peers his learning (Slater & Horstman, 2002). Thus, SD's TVGS of 96.76% is a representation of the encouraging possibilities of such an approach (See Table 1). The approach used in this study is more than AT + SD = vocabulary acquisition. If a formula was written for IDVDMATS 's approach specifically designed for SD, it might read— interactive concept representation + interactive pictorial representation + interactive concept games + authentic literature (like trade books) + choice allowed + discovery learning + story authoring using vocabulary or concepts learned + SD's good reading attitude + the number of AT tools used + teacher KTS=vocabulary acquisition. A single magical AT device or instructional cure to alleviate learning problems or the struggles of students with limited English proficiencies is mythical and does not exist (Gentry, 2006; Male, 1997). However, a blending of knowledge concerning research for such students and the individual learning preferences of students in schools today with AT are fundamental to the nature and individualization philosophy of those called teacher/researcher. Individualization was readily observed in SD's slight change of story line while still maintaining the essence of the original story line (See Figures 10 and 11).

AT Can Get Better!

FLM-6000b. Although the IDVDMATS approach proved successful with SD, the AT could add more student friendly functions. For example, during pre concerning vocabulary learning, SD said, "The pictures in my eyes…told me about words before… I see the word doing…word is there in a way to do…I see it a lot." Pictures were very important to SD's learning the meanings of vocabulary words. The FLM-6000b would be a powerful electronic dictionary if it also included a picture function per definition. The student could type in the word and see pictures relating to definitions of interest. For SD, such a capability would be valuable. The FLM-6000b synthesized speech was difficult and at times incomprehensible to SD. SD expressed this concern at the end of the study with the following comment, "Sometimes I could not tell what the word was and had to push the SAY button to keep hearing it. I was able to get it, but I wish it [SD pointed to the FLM-6000b] sounded like me [SD pointed to the speaker grid on the FLM-6000b]… I need it to sound better to really get it in one time." SD described the desire to hear the words in human speech. Although the synthesized speech was a problem, SD could make out the enunciation of the words after several hearings of the word using the synthesized speech SAY function. However, a student with a poor attitude toward reading and with less interest toward reading a certain text may not persevere like SD with such difficulty (Mathewson, 2000).

Power Point 2003. Power Point 2003 proved to be the easiest AT for SD in the study. He had prior experience with Power Point 2003 and was able to use some of the more advanced function like adding sounds from the Internet to further the reader's experience with story he created. Power Point 2003 was uniquely configured to build a sequential story by its design of slides which can be moved to a desired place in the presentation and an author's ability to insert pictures, text, and sounds to tell a story. Prior experience with technological tools may be one of the most accommodating experiences a student can have when using these tools to express new learning. Newer versions of Power Point could have an authoring book feature for students which offer students and teachers the ability to print and thus publish work in book and Web page forms. Software exists which performs authoring capabilities for struggling students, but Microsoft Office with tools like Power Point are taught to students from elementary to high schools. Its availability and use in schools could be a consideration by Microsoft as software engineers develop new versions or school versions of its products.

Future Research

This descriptive case study example is limited in its generalizability to learning disabled and limited English proficient students with poor attitudes toward reading or limited or no exposure with AT. Yet, this study begins a discussion concerning the needs of students within a special learning dichotomy— learning disabled and limited English proficient. AT's role for students like SD will continue to change as technology continues to change (Leu, 2000). Future research following the individualization philosophy (Gentry, Fowler, & Nichols, 2007) found in IDVDMATS is needed. Research illustrating the adaptability of IDVDMATS with various students may aid the further development of IDVDMATS with various ATs already available or yet to be invented. Descriptive case study research projects which investigate special populations like the learning disabled and limited English proficiency are a necessity.

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